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AUTHOR Matthews, Doris B.
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ABSTRACT

Studies of the human brain suggest that cerebral dominance, the preference for either the right or the left hemisphere to direct the body's behavior, plays a causal role in distinctive learning styles and behavior patterns. The two halves of the brain are physically almost identical at birth, but childhood experiences which utilize one hemisphere more than the other provide "training" and result in the dominance of different modes of thought, i.e., sequential, verbal, analytic and logical for the left hemisphere and holistic, visual, metaphoric and intuitive for the right hemisphere. When the integration of the two hemisphere functions does not take place, a strong or extreme preference for one mode over another can result in learning and behavior problems. Tools are available to aid those in the helping professions identify hemisphere preference, e.g., the Cerebral Dominance Observation Guide, measurements of reaction time and eye movements, and a dichotic listening test. Helping professionals should provide learning or counseling techniques which will exercise the unstimulated hemisphere and work toward the integrated functioning of the two hemispheres. (MCF)

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CEREBRAL DOMINANCE: ITS USE IN UNDERSTANDING LEARNING STYLES

AND

BEHAVIORAL PATTERNS

Doris B. Matthews, Ph.D.
Professor of Education
South Carolina State College
Orangeburg, South Carolina

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CEREBRAL DOMINANCE: ITS USE IN UNDERSTANDING LEARNING STYLES AND BEHAVIORAL PATTERNS

Introduction

The helping profession has always been baffled by the uniqueness of each individual's learning style and behavioral pattern. In trying to understand and to organize observations of behavior, descriptive bipolar words--inductive vs. deductive, analytical vs. thematic, rigidity vs. tolerance for ambiguity, verbal vs. nonverbal, fluid vs. crystallized, propositional vs. appositional, reflective vs. impulsive, structural vs. unstructured, convergent vs. divergent, field dependent vs. field independent, and auditory-vocal vs. visual-motor--have been used to sort individuals. Within the past several decades, systematic research has confirmed that some individuals do possess a set of characteristics that appear to be different or opposite from others. Studies of the human brain have suggested that a new variable called "cerebral dominance" may play a causal role in distinctive patterns.

"Cerebral dominance" has to do with the relationship between the two hemispheres and the preference of either the left or right hemisphere to direct the body's behavior. People differ in the extent to which they rely on one hemisphere of the brain in preference to the other.

People who are "right-dominant" reflect a different set of abilities and personality traits than those who are "left-

dominant." Some learning tasks seem strongly associated with a single hemisphere of the brain, but most allow the learner some flexibility in the balance of hemisphere functions brought to bear upon attainment of a given task. For reasons not yet fully understood, some children learn to favor those functions characteristic of a given hemisphere and show a predisposition to be "right-dominant" or "left-dominant" individuals. Others show no such predisposition and integrate the functions of both hemispheres smoothly in efficient concert.

The present paper attempts to explain hemispheric developmental concepts in relationship to modes of thinking or learning styles and behavioral patterns. According to "cerebral dominance" theory, children can be categorized as functioning with (1) the right cerebral hemisphere mode, characterized by lateral, holistic, intuitive, and spatial thinking; (2) the left cerebral hemisphere mode, which uses vertical, logical, linear, and verbal thinking; or (3) the integrated or synergetic mode, which combines the functions of both. These categories are the poles and midpoint of a continuum.

The Durality of the Brain

Research studies have determined that the human brain is, in fact, two organs rather than one (Gazzaniga, 1975). These two parts or hemispheres, while alike in appearance, have quite different characteristics. In providing for proper functioning of the body, the hemispheres work alike in that each carries half of the load. The right hemisphere controls the motor and sensory operations of the left side of the body, the left hand,

and half of each retina. The left hemisphere controls the same operations on the right side of the body. Although the hemispheres operate independently, they are connected by a bundle of nerve tissue called the corpus callosum. The corpus callosum integrates the operations of the two hemispheres.

In addition to lateral motor and perceptual control, each hemisphere has been found to specialize in a different mode of consciousness. A growing body of research indicates that the left hemisphere predominates in functions associated with speech and language (reading, writing, and calculation). This hemisphere processes data through a rational, sequential, and analytic procedure. The right hemisphere predominates in nonverbal activity (art, music, media, and meditation) and includes simultaneous, holistic, spatial, and intuitive operations (Sperry, 1975; Ornstein, 1976; Levy and Trevarthen, 1977). Grady and Locke (1978) describe the left hemisphere with descriptors such as linear, sequential, verbal, analytic, rational, propositional, explicit, and logical and the right hemisphere with descriptors such as simultaneous, holistic, visual, spatial, synthetic, metaphoric, appositional, tacit, and intuitive. Thus the two dominant modes of consciousness are the right hemispheric and the left hemispheric processing systems.

For most individuals, a given function of thought will be performed in a predictable hemisphere. For other individuals, however, a function may be performed within the opposite hemisphere from that predicted or the function may be performed by

both hemispheres. In the latter case, the function is said to exhibit "mixed dominance." Staley (1980) reports that functions are "lateralized" or assigned to a single hemisphere in a predictable manner for about ninety to ninety-five percent of the right-handed people in the world and sixty to sixty-five percent of the world's left-handed individuals. For those remaining, the pattern of functions by hemispheres usually is reversed completely. Once sensory information enters the brain, both hemispheres can work cooperatively to process it. Specialization within the hemispheres is typical of the modes of consciousness, however, even though particular functions may be identified in both hemispheres or entirely within the "wrong" hemisphere.

Environmental Effects on Brain Development

Blakeslee (1980) offers a theory of "training" for brain development. He states that the two halves of the brain are physically almost identical at birth but they develop their different modes of thought through a "training" process. The basis of the "training" process is a competitive mechanism that allows only one hemisphere to prevail in a particular task. Since the left hemisphere has a slight genetic advantage for verbal sounds, it tends to win the competition in responding to verbal inputs. Each time this happens, the left hemisphere's verbal advantage is increased slightly because of reinforcement. As the child matures, the gulf between the language abilities of the hemisphere widens as a result of this natural thinking process. Since the right hemisphere has less concern for verbal

matters, it continues to operate directly on sensory images, while the left becomes more and more specialized for verbal thinking.

When the left hemisphere is removed at infancy, the right hemisphere has no competition, so it develops its own language abilities. Autopsies performed on seemingly normal individuals have revealed them to have only one cerebral hemisphere. The two hemispheres are physiologically almost identical. Up until the age of approximately six years, the body can transfer functions from one side to the other without permanent damage following brain injury, but after that age extensive therapy may be needed for transfer. Significant differences in learning style and functioning are almost entirely a result of different "training" during childhood (Blakeslee, 1980).

Despite the fact that right brain functions and capabilities are important to effective and creative living and learning, an analysis of Western society and its institutions, including the educational system, reveals a preponderant reliance on the left hemisphere compared to the right (Rennels, 1976). Konicek (1975) feels that this imbalance continues because those functions which society values are performed by the left hemisphere, and, typically, the kinds of thought performed best by the right hemisphere are not recognized as legitimate. Only in sleep, day-dreaming, or fantasy, or in relaxed states or states of extended consciousness, are thoughts of the right cerebral hemisphere allowed to intrude upon consciousness.

What is suggested by the research of Samples (1975), Ornstein (1976), and Sperry (1975) is that different cultures educate their youth differentially, some focusing on left hemispheric functioning and others on right hemispheric functioning. Samples (1977) found that in Japan, where one alphabet is phonetic (symbols of a sound) and one is visual (picture of a sound), children diagnosed as being dyslexic were dyslexic only in the phonetic alphabet, not in the picture alphabet.

In the United States one sees evidence that parenting and educational influences determine styles of learning and behavioral patterns. For example, Fadely and Hosler (1979) discovered that children from homes where language, love, and security are restricted fixate in the right cerebral hemisphere but show signs of overall brain deficiency. They also found that children who come from homes where there has been a positive and nurturing environment but a lack of effective language and social development are very creative. Such children derive enjoyment from extended solitary activity, devoid of the usual social interaction so valued in society. Likewise, children from homes which are highly verbal and moralistic may develop a high left minded "mental set" which effectively thwarts natural tendencies toward exploration and experimentation.

Neil Postman (1979) in his book, Teaching as a Conserving Activity, has hinted that continuous TV watching conceivably could have the effect of weakening left brain activity, producing a population of "right-brained" people. TV conditioning leads to the expectation that there will be a new point of view or focus

of interest or even subject matter every few minutes, and young people find it increasingly difficult to sustain attention in situations which demand a fixed point of view or an extended linear progression. Some educators believe that the decline in Scholastic Achievement Test scores and other standardized measures is related to poor matching of testing styles with those learning styles which result from environmental conditioning by the electronic revolution.

The foregoing may be summarized in the observation that children, because of a great variety of reasons, may differ greatly with regard to their hemispheric dominance and preference. In understanding and coping with their environments, some individuals have a preference for left brain functioning and may demonstrate superiority in logical and sequential thinking and verbalization. Other individuals may prefer a more intuitive and holistic right brain approach to understanding and exploring concepts, ideas, and processes. Many individuals, on the other hand, appear to have no hemispheric preference and are comfortable relying on either hemisphere when coping with their environment.

Sex Differences in Brain Functioning

Contrary to recent thinking, psychobiological research (Restak, 1979) indicates that many differences in brain function between the sexes are innate, biologically determined, and relatively resistant to changes through the influences of culture. Girls are more sensitive to sound and thus develop better verbal skills than boys. Stuttering occurs almost

exclusively among boys. Females read sooner, learn foreign languages easier, and excel academically in the left hemisperic world of the school. They are also more proficient at fine motor performance.

Boys, in contrast, show an early superiority in visual acuity, which compensates to some extent for their lowered auditory capacities. Boys are clumsier, performing poorly in fine motor performance but doing better in gross total body movements, particularly those requiring fast reaction times. Guilford (1967) found that boys score better on tests measuring completion, spatial orientation, spatial visualization, mazes, arithmetic reasoning and girls score better on tests measuring verbal analogy, vocabulary, similarities, memory, word fluency, ideational fluency, expressional fluency, and symbol identities. Males tend to score higher on the type of test that is best solved by holistic right-brain thinking and girls on tests designed for left hemisphere thinking.

These differences can be explained partially by the faster rate of maturation and reduced lateralization in the hemispheres of the female (Blakeslee, 1980). Slow maturation such as that noted in boys means more time for differentiation and organization of the nervous system.

Recognition of Cerebral Dominance

There are a number of ways to determine right hemispheric dominance, a preference for naturalized, non-verbal activities; left hemispheric dominance, a preference for learned, verbal,

socialized activities; and the integrative mode, a shifting in preference to the hemisphere specialized for the task with the other hemisphere acting as a support system. Some of the techniques will be described below.

The first and easiest tool for the helping professional is observation. The left hemispheric child respects the culture's social values, is time-and sequence-oriented, can identify with places which are both specific and general, shows verbal ability in describing places and gives evidence of logic. The right hemispheric child demonstrates experiences of timeless space, a lack of organization and responsibility, and unconventional values; is imaginative and creative; solves problems through development of unconventional alternates; and has a proclivity toward self-indulgence, determination to perform his or her will, and an unbounded desire for exploration. The integrated child has characteristics of both the right and left organizational patterns, for this child has learned that the two hemispheres working together yields better productivity.

Fadely and Hosler (1970) have developed an observational instrument, Cerebral Dominance Observation Guide, to be used by the helping profession which will assist in the identification of children with the extreme modes of preference. It is divided into ten left minded and ten right minded categories with five descriptions of behavior outlined under each category. The list for left-minded characteristics are (1) verbally expressive, (2) logical, (3) orderly and sequential,(4) time orientation, (5) socialized values, (6) aggressive assertive, (7) abstract thought,

(8) vertical thought-structured, (9) objective, and (10) conventional motor organization. On the other hand, right minded characteristics are (1) motorically expressive, (2) intuitive, (3) holistic and gestalt, (4) spatial orientation, (5) naturalistic values, (6) submissive accepting, (7) concrete thought, (8) lateral thought-creative, (9) subjective, and (10) mixed and unconventional motor organization. The behavioral, cognitive, affective, and personality factors are designed to provide a structured means of objectively establishing cerebral dominance.

A second tool is the Wechsler Intelligence Scale for Children--Revised (WISC-R). According to Kaufman (1979) the verbal and mathematical subtests in the verbal scale are predominantly in the domain of the left hemisphere. Some of the other activities require some right brain thinking but, by and large, a child's verbal IQ reflects left-hemisphere processing. In contrast, the performance scale dichotomizes into tasks that seem to require right-brain functioning and those that are primarily dependent on a dynamic integration of the cognitive styles of the two hemispheres. Picture completion and object assembly are classified as right brain processing activities and picture arrangement, block design, coding, and mazes are categorized as integrated functions. Some specialists (Fadely and Hosler, 1979), however, say that a good indicator for either of the extremes is a decrepancy score of 15 or more points in the direction of verbal or performance.

Another way to assess brain dominance is by measuring reaction time to tasks presented to the left or right visual field. Beamon (1974) used a given word for the learner to figure out whether the word was part of a set of words previously memorized. The subjects were asked to press a "yes" or "no" button as soon as they knew whether the word was one of those memorized. When the word was flashed to the right visual field, reaction time got longer as the number of words in the memorized set was increased, thus the serial approach. When the word was flashed to the left visual field, the reaction time stayed the same no matter how many words were in the memorized set, illustrative of the parallel approach.

One of the easiest tests for cerebral dominance is called a dichotic listening test (Kimura, 1973). A good stereo tape recorder with stereo headphones is all that is needed to give the test. A special tape recording is used which presents conflicting words or sounds to the left and right ears. Though each ear has direct nerve connections to both halves of the brain, the connection to the hemisphere on the opposite side is a little stronger. When conflicting but equal strength audio signals are presented to the two ears, one ear or the other will tend to dominate, depending on which hemisphere is better equipped to interpret the sound.

Eye movement studies have been used to determine hemispheric preference (Gur and Gur, 1977). Since each hemisphere is primarily responsible for attending to the opposite side of the body, there is a reflex eye movement toward the opposite side of

whenever one side of the brain becomes attentive. Activation of the left hemisphere thus causes the eyes to orient right, since the right side of the body is under control of the left hemisphere. This eye movement away from the activated side of the brain is an excellent indication of which hemisphere is being used. When a person is asked a question, his or her eyes will momentarily glance to the left or the right while he or she reflects on the answer. If the question is a verbal question, the eye movement will generally be to the right indicating left-hemisphere activation. If a question requiring spatial thought is asked, the eyes most often move to the left.

Some self-report instruments have been constructed. One instrument, Your Style of Learning and Thinking, developed by Torrance, Riegel, and Reynolds (1976), is representative of this category. It is a 40-item multiple-choice inventory of styles of learning and thinking derived from research and theory concerning the specialized functions of the right and left hemispheres of the brain. It is easier to use than most of the performance tests that have been devised for this purpose and has more useful feedback properties. It classifies individuals into three categories: right brained, left brained or integrated. Considerable evidence has been accumulated concerning test-retest reliability and validity.

The recognition of cerebral dominance is a fascinating area and one which intriques psychologists, counselors, and teachers. Although there are methods of assessing qualities that appear to be related to hemispheric preference, more instrumentation is

needed.

Learning and Personality Problems of the Two Extremes

The right cerebral dominant child is described by Fadely and Hosler (1978) as one that touches, wiggles, talks, and examines his or her surroundings and may even fall into fantasies and daydreaming. Such a child may lose track of time, is unorganized, and exhibits difficulty in reading and completing assignments. The child is impulsive and tends to behave without reflective thought. Egocentric behavior and frequent mood changes are characteristics of this individual.

The right brained child also may display poor hand dominance: that is, he or she may use different hands for different tasks. This individual may have difficulty relating verbal directions to motor movements and may make numerous errors in reading due to letter, number, and even word reversals ("was" for "saw," "b" for "d," or "6" for "9,"). Though able to recall vididly places he or she has visited, such a child has difficulty recalling names, dates, or other verbal information associated with imagery or experience. This child may have visual tracking and scanning deficits and difficulty with a phonetic orientation in reading. Word calling is a common problem because the word is recognized but not the visual imagery. Often attentional difficulty is noted: that is, the child actually may be unable to hear a question while writing.

The left brained child is obsessed with winning, being first, gaining all the attention of the adults, being first in

line and the best reader, and engaging in many behaviors which are so competitive as to earn rejection by other children. Assignments are always submitted on time and are done neatly and orderly. This individual places great emphasis on social behavior and desires many friends.

For the left hemispheric child, problems usually are solved through language rather than fist fights. A frequent defense mechanism used by this individual is intellectualization. This child is usually competent in reading, writing, and figuring and tends to show a decided preference for tests of verbal skills on the WISC-R Intelligence Test.

Implications for the Helping Profession

The information on brain development tends to support the idea that right cerebral hemispheric dominant individuals learn better by visual and manipulative methods of instruction, whereas the left hemispheric dominant child prefers the auditory mode. The tactile and auditory modes tend to blend well for many children.

In the foregoing discussion the learning style preference of a large number of girls was shown to be auditory and verbal, styles characteristic of left hemispheric dominance. Boys were shown to prefer visual and manipulative styles, as one would predict for right-brain dominance. However, large numbers of individuals do not categorize easily into these modes by sex. A number of factors must be considered to determine dominance.

The right brained child responds better in reading to the "look and say" method or the language experience chart that

Sylvia Ashton-Warner (1971) describes as the organic approach. Picture clues and configuration clues are important. Spelling words must be visualized and learned as a whole, not in phonetic parts. Arithmetic is learned best by pictures or the manipulation of real objects. Learning centers often provide an opportunity for much needed movements. This individual is an active learner who enjoys physical activities.

In order for the right hemispheric child to learn to function in the classroom, he or she must have behavioral limits within structured learning environments and supportive, constant, and definitive limits at home (Fadely and Hosler, 1979). It is important that the child learns the socialization process in order not only to function in society but, most importantly, to develop a positive self-concept.

To psychologists and counselors the authors suggest the use of play, art and music therapy when a child functions best through the right hemispheric mode. Verbal methods should be reserved for children who behave integrated or left brained.

The left cerebral dominated child learns reading best through the phonetic approach with great emphasis on structural analysis. It follows then that spelling is best taught through this approach also. This child learns to solve problems in arithmetic by the use of symbols. Although this individual may lack original ideas, the grammatical structure revealed in writing assignments is superior. Gym class is a must for this child because he or she frequently dislikes physical exercises.

The goal of the helping professional in adapting to the needs of the student is to accept the preference in learning and to work toward an integration between the two hemispheres; that is, to introduce materials or counseling techniques in both a linear and a visual spatial manner. An integrated mode will utilize both hemispheres individually as needed and will utilize the hemispheres jointly when appropriate. This practice will provide additional flexibility in mental skills and brain utilization. The integrated learning style exhibits traits of unity, synthesis, and balance. This style is called by Grady and Luecke (1973) as the synergetic mode, meaning that the whole is more than the sum of the two parts.

In training the brain for the integrated approach, stress needs to be placed on integrated methods. Role playing, telling stories and gestures, taking field trips, singing songs and improvising movements, choral reading, and demonstrating with concrete objects are a few examples of integrated activities. Emphasis in the curriculum on values clarification exercises and moral dilemma discussions trains both hemispheres. Interdisciplinary approaches to content stimulates the right and left hemispheres of the brain. Autogenic training to help the brain move from one brain wave state to another enables the child to function as a whole individual also.

Project IMPACT (Interdisciplinary Model Program in the Arts for Children and Teachers) (Ragan and Shepherd, 1977) initiated in the schools of Alabama, California, Ohio, Oregon, and Pennsylvania, demonstrates the integrated approach to curriculum

development. An evaluation of IMPACT revealed that students learned the basics as well as before and, in some instances, better. The climate in the classroom became more open, exciting, and challenging. Student self-concept improved and absenteeism was reduced.

Creativity may be described best as the effective integration of both hemispheres of the brain (Garrett, 1976). Most acts of creativity requires an individual's right hemisphere to sense something visually or spatially or through dreams, meditation, fantasy, or intuition. Such sensations of thoughts then can be transmitted through the corpus callosum to the left hemisphere. The left brain becomes responsible for manipulating the tools of language appropriately for expressing the vision.

Summary

For a large portion of the population the dichotomy between right and left hemispheric preference is useless because the two hemispheres work together in processing information which allows the brain to interpret the environment in meaningful wholes. However, for some individuals development does not occur in this orderly pattern, and children experience difficulty adjusting to the socialized, verbal world. Likewise, other children are not balanced in their adjustment because they have not exercised the right hemisphere.

Research has confirmed that stimulation of the under-exercised hemisphere can produce beneficial results. This is the reason that the helping profession must be able to recognize behavioral patterns which indicate a strong preference for one

mode of processing over another. Through appropriate therapy, teaching techniques, and curriculum design, the child can be assisted in the development of an integrated mode of thinking and behaving which better equips him or her for the electronic/computer age of today.

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